

IN THE UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

JACK ROBERSON and WILLIAM RODGERS,

Appellants,

v.

UNITED STATES OF AMERICA,

Appellee.

No. 20832

UNITED STATES OF AMERICA,

Appellant,

v.

MERRITT-CHAPMAN & SCOTT CORPORATION,

Appellee.

No. 20833

MERRITT-CHAPMAN & SCOTT CORPORATION,

Appellant,

v.

UNITED STATES OF AMERICA,

Appellee.

No. 20834

REPLY BRIEF OF APPELLANTS ROBERSON
AND RODGERS

Mark Wilmer
Charles M. Brewer, Brewer and Mallamo
Daniel C. Olney

Luhrs Building
Phoenix, Arizona 85003
Attorneys for Appellants
Roberson and Rodgers

FILED

JUN 8 1967

WM. B. LUCK, CLERK

JUN 13 1967

IN THE UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

JACK ROBERSON and WILLIAM RODGERS,
Appellants,

v.

UNITED STATES OF AMERICA,
Appellee.

No. 20832

UNITED STATES OF AMERICA,
Appellant,

v.

MERRITT-CHAPMAN & SCOTT CORPORATION,
Appellee.

No. 20833

MERRITT-CHAPMAN & SCOTT CORPORATION,
Appellant,

v.

UNITED STATES OF AMERICA,
Appellee.

No. 20834

REPLY BRIEF OF APPELLANTS ROBERSON
AND RODGERS

Mark Wilmer
Charles M. Brewer, Brewer and Mallamo
Daniel C. Olney

Luhrs Building
Phoenix, Arizona 85003
Attorneys for Appellants
Roberson and Rodgers

I N D E X

	<u>Page</u>
Preface.	1
Argument:	
I The Government, by contract, "re- tained control" over the manner and performance of the "pressure grouting" operation and thereby was under a duty to exercise reasonable care for the safety of appellants	8
II Under well settled Arizona law, an owner, having exercised control over the details of the "pressure grouting" operation and over the safety program with respect thereto, has a duty to protect workmen employed on the job and to prudently exercise such con- trols retained over the performance of the work and the jobsite.	16
III The failure of the Government to prudently exercise adequate controls over the equipment, working condi- tions and safety precautions with respect to the grouting operations was the proximate cause of the in- juries sustained by appellants herein.	18
Conclusion	19
Certification.	20

TABLE OF CASES AND AUTHORITIES

<u>Cases</u>	<u>Page</u>
Fluor Corp. v. Sykes, 3 Ariz. App. 211, 413 P.2d 270.	17
Galena Oaks Corp. v. Scofield, 218 F.2d 217 (5th Cir. 1954).	2,16
Grogan v. United States, 341 F.2d 39	2,3
Kirk v. United States, 270 F.2d 110.	2,3
United States v. U. S. Gypsum Co., 333 U.S. 364, 68 S.Ct. 525, 92 L.Ed. 746 (1948)	2,15
Welker v. Kennecott Copper Co., 1 Ariz. App. 395, 403 P.2d 330.	17

Statutes

Arizona Revised Statutes:

§ 23-803.	16
§ 23-806 (Employer's Liability Law)	19

Other Authority

Rules of Civil Procedure, Rule 52(a)	1
--	---



IN THE UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

PREFACE

Appellants' reply will be addressed to the arguments contained in the answering briefs of the "Government" and the "Contractor" to the extent that they discuss matters raised in appellants' opening brief.

The Government's treatment of this aspect of the case is found at pages 1-23 of its brief; the Contractor's is found at pages 3-12 of its brief.

At the threshold of our argument, we deem it of the highest importance to assert that, although this is an appeal from a judgment of the District Court entered upon findings of fact and conclusions of law pursuant to Rule 52(a) of the Rules of Civil Procedure, such findings should not be deemed conclusive because, as will appear from the argument, references to the transcript, and applicable law, such findings were made by the trial judge under an erroneous view of the law.

There are two well established principles of

law which should apply to the consideration of this appeal:

1. A finding is "clearly erroneous" when, although there is evidence to support it, the reviewing court on the entire evidence is left with a definite and firm conviction that a mistake has been committed. United States v. U.S. Gypsum Co., 333 U.S. 364, 68 S.Ct. 525, 92 L. Ed. 746 (1948); and

2. A finding is "clearly erroneous" where it is induced by an erroneous view of the law. Galena Oakes Corp. v. Scofield, 218 F.2d 217 (5th Cir. 1954).

A reading of that portion of the transcript in which the findings of the trial court are made (Tr.* 447-450) will reveal that the trial judge plainly stated: "The court, it might be added, is impressed with the reasoning in the following cases, among other cases: Kirk v. U.S., 270 F.2d 110; and Grogan v. U.S., 341 F.2d 39." (Tr. 450). These cases hold that the initiation of a safety program and the conduct of periodic inspections by

* "Tr." denotes Transcript of Record.

the government will not render it liable under the Federal Tort Claims Act for injuries sustained by an employee on the job as a result of the contractor's negligence. Neither of the foregoing cases deals with a contract where the government actually retains control over a substantial portion of the work or of the safety program implemented in connection therewith.

Both the Government and the Contractor rely on the holdings of the two latter cases, which in our respectful submission controlled the decision of the trial court, and urge that the rules laid down therein are dispositive of this appeal.

Manifestly, the court below was in error, since both Kirk and Grogan, supra, are inapposite. The facts of the instant case on appeal are clearly distinguishable. The facts giving rise to these distinctions are undisputed, documented and clearly shown in the evidence as follows:

1. The Government, by contract provision, retained control over the manner and performance of that phase of the work upon the dam known and described in the plans and specifications as

"PRESSURE GROUTING," by reason of which its duties to exercise due care for the safety of the employees of the Contractor in this hazardous operation were not delegable.

2. Under well settled Arizona law, an owner, having exercised control over the details of the "pressure grouting" operation and over the safety program with respect thereto, has a duty to protect workmen employed on the job, and to prudently exercise such controls retained over the performance of the work and the jobsite.

3. The failure of the Government to prudently exercise adequate controls over the equipment, working conditions and safety precautions with respect to the grouting operations was the proximate cause of the injuries sustained by appellants herein.

In connection with the foregoing statements, we deem it important that this court be apprised of the provisions of the contract (Defendant's Exhibit A in evidence), having reference to the "PRESSURE GROUTING" requirements contained therein. The court's attention is directed to Volume 1 of the "Schedule, General Provisions, Specifications

and Drawings" of the Glen Canyon Dam and Power Plant promulgated by the United States Department of the Interior, Bureau of Reclamation, for this project. The specifications for "PRESSURE GROUTING" include paragraphs 72 through 81; commencing at page 64 of said volume and continuing through and including page 78.*

At the time of the accident, the "PRESSURE GROUTING" operation was in progress in the west spillway tunnel at a height of approximately 532 feet above the Colorado River. "Pressure Grouting" is done by drilling what are called "grout holes" through the walls of the spillway tunnel into the surrounding rock, and thereafter forcing a cement and water mixture under pressure into the spaces and holes between the rock face and the outside of the tunnel wall. As shown by the Specifications, the number, location, depth and direction of these grout holes are controlled exclusively by the contracting officer or his representative, and require that drills, drill bits, pumps and pumping equipment be located and maintained within the tunnel itself

* Reproduced verbatim in Appendix pp. A1-23.

and along its entire course from top to bottom. The drilling and grouting equipment, the grout material, and the men engaged in the performance of the work, together with the Government inspectors and engineers, are carried upon a type of scaffold or platform which has been described in the evidence and in the briefs of the parties as the "jumbo." The "jumbo" was initially designed with safety features such as wire mesh fence around it; safety nets were slung underneath to catch falling objects or workmen; handrails were also attached and toe boards were constructed to prevent the workmen from falling off of or under the jumbo. Because the Government retained the absolute control over the location and direction of the grout holes, certain portions of the jumbo had to be removed from time to time, and it will be demonstrated that in certain instances a handrail would have to be removed because it interfered with the drilling of a grout hole, placed at such a point by the Government. In like manner, certain safety cables and/or the wire mesh fencing would have to be removed because they interfered with the

placement of the drill at the location of the grout hole required to be drilled by the contracting officer or his representatives. Toe boards were removed to allow placement of a ladder and other structures on the jumbo floor in carrying out the work under the direction and supervision of the Government agents.

The "Government" and the "Contractor" utterly ignore the provisions of the contract and features thereof described above which gave the Government absolute control of the pressure grouting operations. It is for this reason that we assert here that the trial court decided this case upon an erroneous view of the law for, if the Government retained control of such operations, its duty to exercise due care in the performance of the work and for the safety of the workmen cannot be denied, nor could this duty be delegated to the Contractor.

Under the circumstances outlined above, and more particularly demonstrated in our argument, it is submitted that the judgment entered in the case must be reversed and the case remanded for further proceedings in the trial court below.

A R G U M E N T

1. The Government, by contract, "retained control" over the manner and performance of the "pressure grouting" operation and thereby was under a duty to exercise reasonable care for the safety of appellants.
-

Counsel for the Government, at pages 9-10, 13-14 of its answering brief, reiterates that the Government did not retain "control" over any of the work so as to subject it to liability by appellants. At page 15 we are challenged to point out contract provisions whereby the Government retained control over the work. Appellants accept this challenge and demonstrate that the Government's position is palpably erroneous with respect to the "PRESSURE GROUTING" operations.

A careful reading of each of the paragraphs, reference to pressure grouting, contained in the contract and set forth in the appendix hereto will clearly reveal that, as to this feature of the contract, the Government was in absolute control of the performance of this work and, of necessity, not only controlled the workmen on the job, but also the method and means by which the grouting

procedures were carried out.

These procedures and the Government's control thereof actually resulted in the unsafe condition of the jumbo at the time of the accident, since it is admitted that there were no toe boards, hand-rails, or safety netting in place in the front of the jumbo at the time it dropped out from under the two injured employees, appellants here.

For instance, Truman Barlow, an eyewitness to the accident, who was on the jumbo at the time, testified that he was employed as a laborer for the "Contractor" engaged in "grouting off of it" (Tr. 87). He also ran the jackhammer drilling holes (Tr. 89). On cross-examination, he stated:

"A I was a grouter. When this took place -- And when you say move the jumbo, sometimes we move it two feet and grout for a whole day; sometimes we move it twenty feet; sometimes back and forth. It just doesn't all take place -- I mean, you just don't move the jumbo a long ways and then grout for some time; it's all done simultaneously." (Tr. 92)

The Government cannot disassociate the grouting operation from the condition of the jumbo or the rigging thereof because this same witness also testified:

"A Well, it isn't exactly the way you make it sound. You just about have to be there to understand it. Jack and the boys do the rigging, at the same time we can be grouting, and this jumbo can be being worked on at the same time we can be grouting off of it." (Tr. 93)

Additionally, the witness Ben W. Mullins, a grout foreman for the Contractor, testified:

"Q All right. Up until that time, when was the last time you grouted off of that jumbo?

A Well, we had finished this grouting and then they pulled it up to take the sandwich out of the sections and -- I don't know -- a day or two -- I'm not sure.

Q It has been testified here by Mr. Sexton that it was put in around the 15th of March, 1964. There, I take it that it had been in the use of grouting for almost a month, with the exceptions of the center section coming out, which took a couple of days, one or two days, is that right?

A Yes.

Q During that month did you work on it as a grouting supervisor?

A Yes." * * * (Tr. 372)

And it was during these grouting operations that the handrails were broken off (Tr. 373). No cable rails were up, nor was there any wire screening around the front of the jumbo (Tr. 373).

"Q When was the last time you saw them on there prior to the accident? I mean the toe boards on the front of the lower platform on the upstream side?

* * *

A I couldn't say definite. They were just knocked off, and this and that and the other." (Tr. 375)

On cross-examination this witness testified to the removal of safety cables and handrails when their presence interfered with the drilling and grouting operations; also to the fact that the Government inspectors directed their replacement (Tr. 387-88).

James Sexton, an ironworker for the Contractor, testified that when this identical jumbo was in the east spillway, "it got pretty well tore up."

"Q What do you mean, it got tore up? What would tear it up?

A Well, if a piece of handrail or this chain link fence that we had across here, if it was in the way it would have to be removed to get the -- they used air drills or core drills for drilling into this concrete tunnel, and they were quite long, you know, the shafts on them, and if they were in the way they would have to be removed, and they didn't get replaced like they should.

* * *

Q Mr. Sexton, with respect to that jumbo, can you see any toeboards on it?

A No. The toeboards, they were underneath the jumbo. These two angles that are there, that's what they were bolted onto. But, they had been removed -- well, we put them back on I think maybe once, but they had been removed because it was in the way of some kind of scaffolding they had to get on right at the floor, and they just didn't put them back on." (Tr. 155-57)

The deposition of Eugene B. Anderson, a supervisory construction engineer for the Government, was admitted into evidence (Tr. 402). This witness was the chief of grouting operations at Glen Canyon Dam at the time of the accident in question (Tr. 139); (Anderson depo. 4). It is significant that he looked at the pin which held the jumbo about a week or ten days prior to the date of the accident (Anderson depo. 5). He had inspected the cause of the prior slipping of the jumbo which had occurred on April 8 or 9 (Anderson depo. 6). He admitted that the jumbo should not have been rigged to one pin. He stated: "That should never have been done. That was the way it was rigged up. We had not accepted it for working, for a working platform yet at the time." (Anderson depo. 12). He had looked at the pin many times (Anderson depo. 19) and knew

that the pin bent from too heavy a load on it (Anderson depo. 22). Notwithstanding his actual knowledge of the dangers inherent in the rigging of the jumbo, he testified that he and his men had ordered the jumbo to be cleaned up on account of the "mess" that was on it:

"Q Who is 'we'?

A Well, I and my inspectors, Ralph Lane, and after all, you have a bunch of hoses. You have some pumps, pipes, drills and everything, just to tidy up a little bit, just do a little bit of housecleaning." (Anderson depo. 16).

It is undisputed that three or four laborers, including the witness Barlow, were on the jumbo during the cleanup work. Mr. Anderson testified further:

"Q Well, would you have gotten on the jumbo?

A I don't believe so. If I had -- if I had -- because I would have looked the situation over first. And I think I would have recommended to the Contractor that -- I would have brought the question up to him, anyway, as to the adequacy of his rigging.

Q Then, I take it because of the rigging that existed prior to the accident between the 8th and the 15th, you personally wouldn't have gone down on that jumbo?

A No, I wouldn't go down on that jumbo,

and I wouldn't want any of my men down there when they are rigging on the jumbo or making any big moves on the jumbo.

Q Why would you let a cleaner go down there or laborer?

A They are contractor's personnel.

Q I mean, he is still a human being.

A Yes, but we are just -- the engineers on the job. The contractor is constructing the job, of course."
(Anderson depo. 25-26)

The foregoing testimony clearly demonstrates that the Government's retention of control over the grouting operation not only was the cause of the dangerous condition of the jumbo, but also that its employees, knowing full well that said jumbo was rigged in an unsafe and dangerous manner (without handrails, safety nets, toe boards or safety cables), ordered and required the Contractor's workmen, including appellants, to work thereon at a height of 532 feet above the river, and to grout or do cleanup when said jumbo was in such perilous condition. This constitutes an utter abandonment of the duty of the Government under the circumstances shown by the evidence. To appreciate the

attitude of the Government while the jumbo was installed in the west spillway, this court's attention is directed to Anderson's entire deposition which was admitted into evidence by the trial judge (Tr. 402), (although it does not appear that the clerk has marked the same as an exhibit). Anderson's apparent indifference to the safety of the men working on the jumbo is contrary to all of the law cited and quoted in appellants' opening brief at pages 23-43 thereof to which reference is hereby made.

In the light of the total evidence on this aspect of the case, we feel that this court will be "left with a definite and firm conviction that a mistake has been committed," rendering the findings of the court clearly erroneous. Furthermore, this same evidence shows that the finding of the trial court reference to the duty of the Government to appellants herein was induced by "an erroneous view of the law." In either case, the findings insofar as they deal with the Government's duties to appellants must be set aside under the rules set forth in United States v. U. S. Gypsum Co.,

and Galena Oakes Corp. v. Scofield, supra. The findings being erroneous, the judgment cannot stand.

2. Under well settled Arizona law, an owner, having exercised control over the details of the "pressure grouting" operation and over the safety program with respect thereto, has a duty to protect workmen employed on the job and to prudently exercise such controls retained over the performance of the work and the jobsite.

Arizona law classifies this type of work as a hazardous occupation (see § 23-803, A.R.S. quoted in pertinent parts at pp. 55-56 of appellants' opening brief) to the effect that all work performed on ladders or scaffolds of any kind elevated 20 feet or more above the surface constitutes a hazardous occupation. The hazardous nature of the work was recognized by Eugene B. Anderson at page 38 of his deposition and, of course, was recognized by the Government itself (see Plaintiffs' Exhibit 8 quoted in pertinent part at pages 21-22-23 of appellants' opening brief).

Not only was the nature of the work hazardous, but that hazard was increased by reason of the Government's control of the grouting operations which

at times required dismantling or destruction of parts of the jumbo to enable the workers on the platform to drill the grout holes and grout the same at the points and places directed and specified by Government employees. These employees, by reason of the critical nature of this work, had unbridled discretion to cause the grout holes to be drilled through the concrete and steel of the tunnel itself in any direction, to any depth up to 360 feet, and at any place within the tunnel, regardless that portions of the jumbo devoted to the safety of the men had to be removed or destroyed to enable the same to be done.

Given these circumstances, the Arizona decision in Welker v. Kennecott Copper Co., 1 Ariz. App. 395, 403 P.2d 330, becomes controlling upon this court.

An excerpt from this decision is found at pages 42-43 of appellants' opening brief and additional quotations will not be made therefrom. Accord, Fluor Corp. v. Sykes, 3 Ariz. App. 211, 413 P.2d 270.

The effect of Welker v. Kennecott Copper Co., supra, requires that an owner who has undertaken a

program for the safety and protection of employees engaged in hazardous work must exercise due care for the protection of such employees, and that the failure to do so may impose liability. In this case, it is unquestioned that the Government had initiated and conducted extensive safety procedures. The safety inspectors, as noted in our opening brief, at times undertook to direct the Contractor's employees reference to safety measures during the course of construction. Apparently, the Government employees did not extend the practice and protection afforded to the employees at the time the jumbo hung perilously suspended by one cable and hoist anchored by a single pin which yielded and bent due to excessive weight, casting these appellants into the air 532 feet above the river bed.

3. The failure of the Government to prudently exercise adequate controls over the equipment, working conditions and safety precautions with respect to the grouting operations was the proximate cause of the injuries sustained by appellants herein.

Undoubtedly, the Government's failure to exercise due care for the protection of appellants

proximately caused their injury and damage. The only remaining point to be discussed is whether or not the contributory negligence of either of these workmen is a bar to recovery.

Under the Employer's Liability Law, § 23-806, contributory negligence is not a bar to recovery. This section implements the doctrine of comparative negligence under which, of course, if the court finds that appellants here were guilty of some element of contributory negligence, which we do not concede, this factor may be considered in reduction of the amount of the award.

Furthermore, if, as argued at pages 22-23 of the Government's brief, this law only subjects the employer of an injured worker to liability, such liability is extended to the Government, for under the Rule of Non-Delegable Duty, the independent contractor is deemed to be the agent of the government, and the doctrine of respondeat superior applies.

C O N C L U S I O N

For all of the reasons expressed herein, it is

submitted that the judgment appealed from should be vacated, the case reversed and remanded with directions to grant the appellants a new trial.

Respectfully submitted,

Mark Wilmer
Charles Brewer, Brewer and
Mallamo
Daniel C. Olney

By _____
Charles M. Brewer

Attorneys for Appellants
Roberson and Rodgers

CERTIFICATION

I certify that, in connection with the preparation of this brief, I have examined Rules 18 and 19 of the United States Court of Appeals for the Ninth Circuit, and that, in my opinion, the foregoing brief is in full compliance with those rules.

Charles M. Brewer

A P P E N D I X

*

*

*

*

*

*

*

*

Appendix

PRESSURE GROUTING

72. General plan for grouting. The general plan for grouting the rock foundations for structures and for grouting contraction joints in the structures requires that the contractor perform drilling and grouting operations as follows:

(a) Drilling and grouting the rock foundations of the dam and spillway intake structures with low-pressure, shallow grout holes.

(b) Drilling and grouting the rock foundations of the dam with high-pressure, deep curtain, grout holes.

(c) Drilling and grouting the rock surrounding the spillway tunnels and around the diversion tunnel plugs.

(d) Periphery and perimeter grouting around the diversion tunnel plugs, and periphery grouting around the backfill concrete downstream from the diversion tunnel plugs.

(e) Drilling and grouting portions of the rock on both abutments from foundation tunnels. Grout pipe shall also be embedded in the floor of the foundation tunnels at 10-foot centers for future grouting operations beyond the profile of the grout holes shown on the drawings.

(f) Grouting transverse contraction joints 3-4 to 22-23, inclusive, in the dam, all longitudinal contraction joints in the dam, the contraction joints in the diversion tunnel plugs and backfill concrete, and the contraction joints between the tunnel plugs and backfill concrete. Grouting of transverse contraction joints 1-2, 2-3, 23-24, and 24-25 will not be accomplished under this contract.

(g) Placing mortar or grout by the grouting method to complete the placement of concrete lining for the right diversion tunnel outside the limits of the tunnel plug.

(h) Grouting the joints between the second-stage concrete in the ring-follower gate chambers and the surrounding mass concrete.

(i) Drilling and/or grouting at other locations as shown on the drawings or as directed.

The low-pressure, shallow holes are designated on the drawings as B-holes and the high-pressure, deep holes as A-holes. Before any concrete is placed in the dam or in the spillway intake structures, respectively, the near-surface rock of the dam and intake structure foundations, respectively, shall be grouted by means of the B-holes to depths of about 25 feet. Drilling and grouting may be required in the powerplant foundation to seal major surface seams, cracks, crevices, and channels or caverns in the rock. The number and spacing of the B-holes, and the pressures and grout mixes to be used for injections will depend upon the nature of the rock, as disclosed by the foundation excavation, the results of water pressure or other tests, and the results of the actual grouting operations. The main cut-off or grout curtain will be completed by high pressure grouting of the deep A-holes. The drilling and grouting of the A-holes shall be done from the foundation galleries in the dam, from the foundation tunnels, and from other locations as directed. It is contemplated that the A-holes will be drilled at approximately 10-foot spacings and to varying depths, as shown on the drawings, generally up to a depth of 250 feet. If foundation conditions, as revealed by the foundation excavation and the results of grouting operations, indicate that grouting to closer spacings and greater depths is necessary, the contractor will be required to drill some or any number of the holes to 5-foot spacings and to maximum depths of 360 feet and to grout these holes under relatively high pressures as directed.

The amount of drilling and pressure grouting that will be required under this contract is uncertain, and the contractor shall be entitled to no extra compensation above the unit prices bid in the schedule by reason of increased or decreased

quantities, or by reason of the location of the required drilling and grouting.

The work and materials for drilling, hook-up to holes, piping, pressure grouting, and any other work required for placing mortar or grout by the grouting method, to fill the spaces in arches remaining unfilled after the placing of concrete has otherwise been completed, as provided in Paragraph 128, will not be paid for under items of the schedule for pressure grouting operations where the contractor has performed the required excavation, such as for the left diversion tunnel lining, the right diversion tunnel lining within the limits of the tunnel plug, and the inclined portions of the left and right spillway tunnel linings; and the costs thereof shall be included in the prices bid in the schedule for concrete lining. The work and materials for drilling, hook-up to holes, piping, pressure grouting, and any other work required for placing mortar or grout by the grouting method will be paid for under applicable items of the schedule covering pressure grouting operations where the excavation was accomplished under separate contract, such as in the right diversion tunnel outside the limits of the diversion tunnel plug.

73. Core drilling. The contractor shall, where and if directed by the contracting officer, perform such core drilling as may be required to determine the condition of the foundation rock, or the effectiveness of the grouting operations. The requirement for core drilling and the amount thereof will be optional with the contracting officer, and the contractor shall be entitled to no additional allowance above the unit prices bid in the schedule for core drilling NX-holes, and for core drilling 5 and 1/2 inch diameter holes by reason of the location, depth, or a larger amount of or none of this work being required. It may be required that the contractor shall core drill holes from the galleries or tunnels through concrete and steel and into rock. The NX-holes shall not be less than 2 and 15/16 inches in diameter and shall produce cores not less than 2 and 1/16 inches in diameter. All

core drilling NX-holes shall be performed with standard core-drilling equipment, using NX-size bits and double-tube core barrels, and capable to producing cores of the diameter specified. The NX-holes will be required to be drilled to varying depths, with a maximum depth of 200 feet. The 5 and 1/2-inch diameter holes shall produce cores not less than 4 inches in diameter and will be required to be drilled to a depth of not more than 50 feet.

All core drilling shall be performed in a workmanlike manner, by competent and experienced workmen, and special care shall be exercised to obtain cores in as good condition as possible from all holes in material capable of producing satisfactory cores. The drill bit shall be pulled, and the core removed as often as may be necessary to secure the maximum possible amount of core. The contractor shall keep, in the manner prescribed by and shall furnish to the contracting officer, an accurate log of all drill holes, including full descriptions of all materials of whatever character encountered in the drilling, their location in the holes, and the location of special features such as mud seams, open cracks, soft or broken ground, points where abnormal loss of drill water occurred, and any other items of interest in connection with the purpose for which the core drilling is required. The fact that an inspector may be present and keeping a record of the drilling shall not relieve the contractor from the requirement for keeping an accurate log as described above. Wooden core boxes shall be furnished by the contractor. The contractor shall place the cores in the boxes in the correct sequence and segregated accurately by labeled wooden blocks according to the measured distances in the holes. No box shall contain cores from more than one hole. Designating marks, hole numbers, and elevations shall be placed on the boxes and along the line of cores as directed by the contracting officer. The covers shall be fastened securely to the core boxes, and the boxes shall be delivered to the contracting officer at a point designated in the vicinity of the work.

Core drilling will be measured for payment to the actual depth, up to the depth directed, of holes drilled at the direction of the contracting officer. Payment for core drilling described in this paragraph will be made at the applicable unit price per linear foot bid in the schedule for core drilling NX-holes in stage between the depths specified in the schedule, and for core drilling 5 and 1/2-inch diameter holes not more than 50 feet deep, which unit prices shall include the cost of furnishing all labor, materials, tools, and equipment required for drilling the holes; removing the cores; keeping accurate logs of drill holes; boxing and labeling and transporting the cores; and all incidental work connected therewith.

74. Drilling grout holes. Grout holes shall be drilled into the rock foundations at the locations shown on the drawings and as described in Paragraph 72. The use of "rod dope," grease, or other lubricants on the drill rods or in the grout holes will not be permitted. Drilling grout holes with percussion-type drills will not be permitted. The requirement as to depth, spacing, and direction of holes are approximate and subject to revision during the work of drilling, testing, and grouting. It is expected that the required depth of holes will not exceed 360 feet.

Where and if grout holes are required to be drilled to a greater depth than 360 feet, the contractor will not be required to perform drilling beyond such depth at the unit prices bid in the schedule, and payment therefor will be made as provided in Paragraph 7. The location, direction, order of drilling and depth of each hole shall be as shown on the drawings, or as directed by the contracting officer.

The drilling and grouting of A-holes shall be done from the foundation gallery and from the foundation tunnels in the abutments through 1 and 1/2-inch diameter pipe placed into the concrete or rock a minimum of 12 inches, when drilling from the foundation tunnel, and into the concrete a minimum of

24 inches or to the top of the pour lift, when drilling from the gallery. Payment for furnishing pipe and fittings for grouting will be made in accordance with provisions in Paragraph 75.

The minimum diameter of each grout hole shall be not less than that produced by the commercial standard EX-size drill bit, approximately 1 and 1/2 inches. Unless otherwise directed by the contracting officer, the first A and B grout holes under the dam, the first B-holes under the spillway intake structures, and the first rings of grout holes and the first grout holes within each grout ring in the tunnels shall be spaced widely and shall be drilled and grouted before intermediate holes are drilled and grouted, and in this manner the drilling and grouting of all holes, and rings of holes, and the holes within each ring shall be completed with such final spacing of rings and holes as the grouting results show to be necessary. After holes in a region have been drilled and grouted, it may be found necessary to drill additional grout holes. No allowance above the unit prices bid in the schedule will be made for the drilling of such holes or for the expense of moving equipment to other operations and returning to a previously drilled area.

Wherever necessary, as determined by the contracting officer, the drilling and grouting shall be performed in successive operations consisting in each case of drilling the hole to a limited depth, grouting at that depth, cleaning out the grout hole by washing or other suitable means before the grout in the hole has set sufficiently to require redrilling, allowing the grout surrounding the grout hole to attain its initial set, drilling the hole to an additional depth, and then grouting, and thus successively drilling and grouting the hole at various depths within the stages until the required depth of hole is completely drilled and grouted, all as determined by the contracting officer. Redrilling required because of the contractor's failure to clean out a hole before the grout has set shall be performed at the contractor's expense.

Where the grout has been allowed to set in a hole by direction of the contracting officer, the required redrilling will be paid for at the rate of fifty percent (50%) of the unit price per linear foot bid in the schedule for drilling grout holes in stage between depths of 0 foot and 30 feet, regardless of depth. No additional allowance above the unit prices bid in the schedule for drilling grout holes in stage will be made on account of the requirement for interrupting the drilling of holes to permit grouting, on account of the requirement for cleaning out holes before further drilling or on account of any amount of moving of equipment that may be necessary due to the requirement for such successive shallow depth and deeper grouting.

As the construction work progresses, the development of leakage or the condition of the surrounding foundations may indicate that parts of the foundations already covered with concrete require grouting, in which event holes shall be drilled through the concrete and steel and into the underlying or surrounding rock. Pipes for grout connections shall be placed as directed.

Prior to drilling for grouting the formations surrounding the spillway tunnels, including those portions of the diversion tunnels which will ultimately be parts of the spillway tunnels, and the keyed portions of the diversion tunnels, as described in Paragraph 72, the contractor shall complete the placing of concrete lining and the work of placing mortar or grout by the grouting method as provided in Paragraph 128.

When the drilling of each hole has been completed, it shall be protected from becoming clogged or obstructed by being temporarily capped or otherwise suitably protected until it is grouted, and any hole that becomes obstructed before it is grouted shall be opened by and at the expense of the contractor. For determining stage depths of drilling grout holes in rock and concrete measurement will be made from the collar of the hole at the exposed surface of the rock or concrete to the actual depth drilled

into the rock foundation and concrete as directed. Grout holes for pressure grouting will be measured for payment to the actual depth, up to the depth directed, of grout holes drilled into the rock foundation material or concrete at the direction of the contracting officer; Provided, That holes drilled for placing mortar or grout by the grouting method, as described in Paragraph 128 will not be measured for payment in the left diversion tunnel lining and in the inclined portions of the left and right spillway tunnel linings as provided in Paragraph 72.

Payment for drilling holes for setting foundation grout pipe or expansion-type plugs for grouting the rock surrounding the tunnels will be made at the unit price per linear foot bid in the schedule for drilling grout holes in stage between depths of 0 foot and 30 feet. Except as otherwise provided, payment for drilling grout holes will be made at the applicable unit price per linear foot bid in the schedule for drilling grout holes in stage between the depths specified in the schedule, which unit prices shall include the cost of furnishing all labor, materials, tools, and equipment required for drilling the holes; maintaining the holes free from obstructions until grouted; and all incidental work connected therewith.

75. Pipe for foundation grouting. Standard black metal pipe for grout connections shall be set in the concrete or foundation rock in the locations shown on the drawings and described in Paragraph 72. The contractor will have the option of setting regular pipe nipples for tunnel grout hole connections through the concrete lining and into the surrounding rock, if necessary, or of drilling through the concrete lining and using an expansion-type plug for such grout hole connections for pressure grouting the rock surrounding the tunnels and shaft as provided in Paragraph 77. Pipes for grouting shall also be set over springs, crevices in the rock, faults, or other foundation defects, wherever directed. Grout pipes set in concrete shall end not less than 3 inches inside of the finished surface of the concrete. A standard coupling and wrapped

nipple to facilitate removal after grouting shall be attached to the grout pipe and shall extend beyond the finished surface of the concrete as shown on the drawings. The holes left after removal of wrapped nipples shall be filled immediately and completely with drypack in accordance with the provisions of Paragraph 108.

The size of the grout pipe for each hole and the depth of the holes for setting pipe for foundation grouting shall be as shown on the drawings or as directed. The grout pipes shall be anchored into the rock or concrete into which they are inserted, and the spaces around the pipes shall be carefully sealed with oakum, grout, or other suitable material to prevent entry of concrete or other foreign materials prior to grouting. All oakum or other suitable material required for sealing shall be furnished by the contractor. All pipe and fittings to be embedded in rock or concrete shall be cleaned thoroughly of all dirt, grease, grout, and mortar immediately before being embedded in the concrete. The pipe and fittings shall be carefully assembled and placed and shall be held firmly in position and protected from damage until the concrete has set. Care shall be taken to avoid clogging or obstructing the pipes before being grouted, and any pipe that becomes clogged or obstructed from any cause, shall be completely cleaned out or replaced at the expense of and by the contractor.

All standard black pipe and fittings, all nails, tie wire, temporary supports, and other materials required for the work described in this paragraph shall be furnished by the contractor. The pipe shall be type I, class A standard black pipe in accordance with Federal Specification WW-P-406. The pipe fittings shall be malleable iron, type I, in accordance with Federal Specification WW-P-521b. The pipe shall be cut, threaded as necessary, fabricated as required, and placed by the contractor.

Payment for furnishing and placing metal pipe and fittings for foundation grouting and drainage will be made at the unit price per pound bid therefor

in the schedule, which unit price shall include the cost of furnishing, unloading, hauling, storing, handling, and supports and materials required for installation; of protecting the pipe from injury and clogging; and of removing the nipples in exposed faces and filling, with drypack, the holes left by the removal of the nipples. Payment will be made only for the metal pipe and fittings actually installed and left in place as directed by the contracting officer, and no additional allowance above the unit price bid in the schedule will be made on account of the varying size, length, or number of pipes required. No payment will be made for pipe and fittings used for placing mortar or grout by the grouting method in the left diversion tunnel lining or for the inclined portions of the left and right spillway tunnel linings as provided in Paragraph 72. Payment for drilling holes for setting foundation grout pipe and for expansion-type plugs for tunnel grouting will be made at the unit price per linear foot bid in the schedule for drilling grout holes in stage between depths of 0 foot and 30 feet, and only for those holes drilled and included for payment as provided in Paragraph 74.

76. Hook-ups to foundation and tunnel grout holes. Payment for hook-ups to foundation and tunnel grout holes will be made only once for each hole or connection actually hooked onto at the direction of the contracting officer, regardless of the additional number of times packer-settings are made or the same hole is hooked onto, and regardless of the volume of water or grout actually injected into the grout hole or connection. The number of separate grout holes or connections requiring hook-ups, as shown in the schedule, is only approximate and the contractor shall be entitled to no additional compensation above the unit price bid in the schedule by reason of the number of hook-ups actually required to complete the grouting operations as specified in Paragraph 77.

Payment for hook-ups to foundation and tunnel grout holes will be made at the unit price per hook-up bid therefor in the schedule.

Connections to cracks, crevices, or seams in the foundation, and connections to existing exploratory holes, when required, will be considered as grout holes and will be paid for as such under the unit price bid per hook-up in the schedule for hook-ups to foundation grout and tunnel holes. The item of the schedule for hook-ups to foundation and tunnel grout holes does not include the connections necessary for the grouting of contraction joints as specified in Paragraph 81; and does not include the connections necessary for placing mortar or grout by the grouting method as described in Paragraph 128 for those tunnels excavated by the contractor under these specifications.

77. Pressure grouting foundations and tunnels. Each drilled grout hole and grout connection for pressure grouting foundations and rock surrounding tunnels as described in Paragraph 72 shall have grout composed of cement and water forced into it under pressure.

The cement to be used for pressure grouting foundations and tunnels shall be furnished by the contractor in accordance with Paragraph 95. Pressures as high as practicable but which, as determined by trial, are safe against rock or concrete displacement shall be used in the grouting. The proportions of cement and water used in mixing the grout and admixtures where used, the time of grouting, the pressures used for grouting, and all other details of the grouting operations shall be as determined by the contracting officer.

Different grouting pressures will be required for grouting different sections of most of the grout holes. Where such grouting of a hole is directed by the contracting officer, the grouting shall be performed by attaching a packer to the end of a grout-supply pipe, lowering the grout-supply pipe into the hole to the top of the bottom section that is required to be grouted at a different pressure, grouting at the required pressure, allowing the packer to remain in place until there is no back pressure, withdrawing the grout-supply pipe to the top of the next higher section that is required to be grouted at a different pressure, and

thus successively grouting the hole in sections at the specified grouting pressures until the entire hole is completely grouted. The grout-supply pipes and packers shall be furnished by the contractor. The packers shall consist of pneumatic tubes or expansible rings of rubber, leather, or other suitable material attached to the end of the grout-supply pipe. The packers shall be designed so that they can be expanded to seal the drill holes at the specified elevations and, when expanded, shall be capable of withstanding, without leakage, for a period of 5 minutes, water pressure equal to the maximum grout pressures to be used. The amount of packer-grouting that will be required will depend upon the conditions disclosed by the drilling of the grout holes.

All intersected rock crevices, seams, or faults containing clay or other washable materials shall be completely washed with water and air under pressure to remove as much of such materials as possible. Such materials shall be ejected from one or more holes by introducing water under pressure in an adjacent hole. All grout holes shall be thoroughly tested with clean water under continuous pressure up to the required grouting pressure, as determined by the contracting officer, in order to effectively clean intersected cracks and seams and to determine rate of take, and extent of leakage.

The apparatus for mixing and placing grout shall be of a type approved by the contracting officer and shall be capable of effectively mixing and stirring the grout and forcing it into the holes or grout connections in a continuous, uninterrupted flow at any specified pressure up to a maximum of 500 pounds per square inch. The mixer shall be mechanically operated and provided with an accurate meter, reading in cubic feet to tenths of a cubic foot, for controlling the amount of mixing water used in the grout. In addition to the grout mixer, holdover mechanical agitator tanks shall be provided. All grout shall be pumped with a duplex piston-type pump or other type pumping equipment as approved. The grouting equipment shall be

satisfactorily maintained so as to insure continuous and efficient performance during any grouting operation. The arrangement of the grouting equipment shall be such as to provide a supply line and a return line from the grout pump to the grout hole. Provision shall be made to permit continuous circulation and accurate control of grouting pressures and grout flows into the grout holes.

Expansion-type plugs, if used for grout hole connections in tunnel grouting shall be furnished by the contractor. The plugs shall consist of expandable tubes or rings of rubber, leather, or other suitable material, and pipe and fittings. The plugs shall be designed so that they can be expanded to seal the drill holes and, when expanded, shall be capable of withstanding, without leakage, water pressure equal to the maximum grout pressure to be used. The cost of furnishing all necessary materials and labor for constructing and handling expansion-type plugs shall be included in the unit prices per sack bid in the schedule for pressure grouting foundations and tunnels.

If, during the grouting of any hole, grout is found to flow from adjacent grout holes or grout connections in sufficient quantity to interfere seriously with the grouting operation or to cause appreciable loss of grout such connections may be capped temporarily. When grouting is being done with packers, the pressure of the grout returning from any adjacent hole shall be measured by seating a packer in the adjacent hole, and such pressures shall be kept below the allowable pressures for that stage of that hole. Where such capping is not essential, ungrouted holes shall be left open to facilitate the escape of air and water as the grout is forced into other holes. Before the grout has set, the grout pump shall be connected to adjacent capped holes and to other holes from which grout flow was observed, and grouting of all holes shall be completed at the pressures specified for grouting. If, during the grouting of any hole, grout is found to flow from points in the foundations, abutment, or any parts of the structures,

Such flows or leaks shall be plugged or calked by the contractor as directed. The grouting of any hole shall be continued until the hole or grout connection takes grout at the rate of less than 1 cubic foot of the grout mixture in 20 minutes if pressures of 50 pounds per square inch or less are being used, in 15 minutes if pressures between 50 and 100 pounds per square inch are being used, in 10 minutes if pressures between 100 and 200 pounds per square inch are being used, and in 5 minutes if pressures in excess of 200 pounds per square inch are being used. So far as practicable, the full grouting pressure shall be maintained constantly during grout injections. However, as a safeguard against rock or concrete displacement or while grout leaks are being calked, the contracting officer may require the reduction of the pumping pressure, or the discontinuance of pumping. After the grouting of the holes or connections is completed, the pressures shall be maintained by means of stopcocks or other suitable valve devices, until the grout has set sufficiently so that it will be retained in the holes or connections being grouted.

No A-hole shall be grouted until all concrete required within a radius of 200 feet has been placed to a height of not less than 100 feet above the foundation rock or to its full height and has set a sufficient length of time, or until all contraction joints to be grouted under this contract within a radius of 200 feet have been grouted to a minimum height of 50 feet or to their full height, all as determined by the contracting officer. If, during the grouting of the A-holes, leakage develops into the cooling systems, the contraction joints, or the contraction-joint grouting systems, the affected joints and systems shall be flushed thoroughly with water and air alternately until the systems and joints are clean. The cost of washing the cooling systems and contraction joint systems in the above-described manner shall be included in the unit prices bid in the schedule for furnishing and installing metal tubing and fittings for grouting contraction joints and for furnishing and placing 1-inch outside-diameter metal pipe or tubing and



fittings for concrete cooling systems.

Measurement for payment for pressure grouting foundations and rock surrounding the tunnels and tunnel plugs will be made on the basis of the number of sacks of cement actually forced into the holes or grout connections at the direction of the contracting officer, or required to fill permanent pipes; Provided, That measurement for placing mortar or grout by the grouting method in the right diversion tunnel, outside the limits of the diversion tunnel plug, will be made of the number of sacks of cement and cubic feet of sand, measured separately, actually forced into the grout connections. One sack of cement will be considered as 94 pounds. Payment for pressure grouting foundations and tunnels will be made at the applicable unit price per sack bid therefor in the schedule, which unit price shall include the cost of furnishing admixtures where required, all labor, materials, tools and equipment required for the grouting, except that payment for furnishing and handling cement will be made at unit price bid in the schedule for furnishing and handling sacked cement for foundation grouting. Payment for hooking onto each grout hole or grout connection will be made as described in Paragraph 76. No payment will be made for grout or for cement used in grout lost due to improper anchorage of grout pipes or connections, or rejected on account of improper mixing, or lost by leakage due to the failure of the contractor to calk surface leaks when directed. All pressure grouting operations shall be performed in the presence of the contracting officer or his duly authorized representative.

78. Contraction joints in dam. Vertical contraction joints in the concrete of the dam will be provided for convenience in construction and to provide for contraction of the concrete. The details of these joints are shown on the drawings, and all contraction joints shall be constructed in accordance with the details shown, unless otherwise specifically directed in writing, by the contracting officer. Keys shall be built in the contraction



joints as shown on the drawings. The cost of constructing all contraction joints and keys between the blocks of the dam shall be included in the unit prices per cubic yard bid in the schedule for concrete in dam. Metal seals shall be placed in each contraction joint as shown on the drawings or as directed. The metal seals shall be furnished and installed by the contractor and payment therefor will be made in accordance with the provisions of Paragraph 148.

79. Tubing for grouting contraction joints. Systems of thin-wall steel tubing and fittings and grouting outlets shall be placed in the contraction joints in the dam, in the peripheries of the diversion tunnel plugs and backfill concrete, in contraction joints of diversion tunnel plugs and backfill concrete, in the contraction joint in the mass concrete beneath the machine shop, and elsewhere as shown on the drawings or directed. All tubing, fittings, and grouting outlets required shall be furnished by the contractor. All 1/2-inch risers and all 1 and 1/2-inch supply, header return, and vent lines shall be thin-wall electrical metallic tubing in accordance with Federal Specification WW-T-806b. Grout outlets shall be in accordance with Drawing No. 141(222-D-1185). Couplings for connecting together the lengths of plain-end electrical metallic tubing, and connectors used to join the plain-end electrical metallic tubing to standard pipe fittings shall be watertight fittings manufactured expressly for electrical metallic tubing. Tees used to connect the individual risers or grout outlets to the headers shall be galvanized and in accordance with Drawing No. 142(447-D-231). Standard pipe connections shall be galvanized standard weight fittings. Nipples shall be type A, wrought-iron or steel fitting in accordance with Federal Specification WW-N-351. Caps and couplings shall be type II, malleable-iron fittings in accordance with Federal Specification WW-P-521b. All nails, tie wire, wooden plugs, asphalt emulsion for sealing purposes, and temporary supports required for the installation of the grouting systems shall be furnished by the contractor. The asphalt emulsion

shall be in accordance with Bureau of Reclamation "Specifications for Plastic Compound (Paste-type Asphalt Emulsion)," dated February 15, 1948. All tubing shall be cut to length and formed by the contractor.

All tubing and fittings to be embedded in concrete shall be cleaned thoroughly of all dirt, grease, grout, and mortar immediately before being embedded in the concrete. The tubing and fittings shall be carefully assembled and placed and shall be held firmly in position while the concrete is being placed. Care shall be exercised to insure that the 2 companion members of each conduit-box-cover grouting outlet are maintained in accurate alinement and position with respect to each other that each member becomes an integral part of and moves with the concrete mass to which it is anchored. The method of attaching the first member of each grouting outlet to the forms and, in turn, the second member to the first is shown on the drawings. This method shall be adhered to accurately unless it is modified by specific instructions of the contracting officer.

Where grout tubing terminates at a concrete surface exposed to the action of flowing water, the tubing shall terminate in a recess constructed in the surface of the concrete. Where grout tubing terminates at other exposed concrete surfaces, the tubing shall be fitted with a wrapped nipple to facilitate removal as shown on the drawings.

Care shall be taken to insure that all parts of the system are maintained free from dirt and other foreign substances. After each 5-foot lift of the grouting systems is placed in position and before any concrete is placed around it, and at such other times as may be required, the tubing shall be tested by forcing air under pressure through it to determine that the system is completely free from obstructions after which it shall be immediately temporarily capped or otherwise closed to avoid the possibility of any foreign substance entering it until it is pressure grouted.

A continuous flow of water shall be circulated in the ungrouted supply headers of the contraction joint systems in the vicinity of the grouting of any A-hole. Should a contraction joint system become plugged as the result of the A-hole grouting, the contractor shall clean out the system before the grout has taken its initial set, by filling the system approximately half full of water through the supply header of the bedrock lift or the lift above, admitting air under pressure through its lowest return available, and opening and closing the air valves in such a manner as to produce water hammer in the system.

Any tubing that becomes clogged or obstructed before final acceptance of the work, due to any cause, shall, if practicable, be completely opened and cleaned. For any plugged tubing which the contractor fails to open or to replace, the contractor shall pay to the Government as fixed, agreed, and liquidated damages, the sum of two dollars (\$2) per linear foot of the total length of tubing which is thereby made ineffective, as determined by the testing. After the grouting operations have been completed, the contractor shall remove the grout nipples in the galleries and face of the structures, and all holes left after the removal of the nipples shall be filled immediately and completely with drypack in accordance with the provisions of Paragraph 108.

Payment for all work described in this paragraph will be made at the unit price per pound bid in the schedule for furnishing and installing metal tubing and fittings for grouting contraction joints, which unit price shall include the cost of unloading, hauling, storing, handling, and installing the tubing, fittings, and grouting outlets; of protecting the tubing from injury and clogging; and of removing the nipples in the galleries and face of the structures and filling, with drypack, the holes left by the removal of the nipples. Payment will be made only for the tubing and fittings, including grouting outlets, actually installed in the contraction joints and the computed weight for payment will not include the weight of nails, tie wire, wooden plugs, or temporary supports.



80. Hook-ups to contraction joint grouting systems. Each contraction joint in the dam is divided into a number of separate grouting systems from bedrock to the top of the dam, and each contraction joint grouting system contains its own seals, supply system, and venting system. Hook-ups to these contraction joint grouting systems in the dam and to contraction joint and periphery grouting systems in the tunnel plugs and backfill concrete of the diversion tunnels, and elsewhere as shown on the drawings or directed, will be required to wash out and test the contraction joints and grouting systems prior to grouting, to grout the various contraction joints and, if necessary, to rehook the systems during or after the grouting operations. Methods and procedures for hooking up to contraction joint grouting systems and for washing and testing the contraction joints shall conform to the applicable provisions of Paragraph 81.

Measurement for payment for hook-ups to contraction joints and periphery grout systems will be made of the number of supply lines hooked onto. Return lines, vent lines, and vent return lines hooked onto to complete the grouting of any grouting system will not be measured for payment. Payment for hook-ups to contraction joint grouting systems will be made at the unit price per hook-up bid therefor in the schedule, which unit price shall include the cost of furnishing all labor, materials, tools and equipment necessary to provide access to the joint headers; installing and removing temporary pipe lines to each grout header; hooking up for washing, testing, and grouting each complete contraction joint grouting system; and other incidental work to and during the grouting. Payment will be made only once for hooking up to each supply line of a contraction joint grouting system regardless of the number of times the same system or contraction joint may have to be hooked onto for washing, testing, grouting, or regrouting, or of the number of pipe connections required to insure a complete satisfactory grouting job for each contraction joint. The item of the schedule for hook-ups to contraction joint grouting systems does not include the hooking

up to cooling coils for grouting the cooling coils, and the cost of hooking up to cooling coils shall be included in the price bid in the schedule for pressure grouting contraction joints and cooling systems.

81. Pressure grouting contraction joints and cooling systems. When directed by the contracting officer, which in general will be as soon as possible after the concrete has cooled the desired amount, the contraction joints and embedded cooling coils in the dam and in the mass concrete below the machine shop shall be pressure grouted with cement grout. Grouting of the contraction joints in the dam up to elevation 3450 shall be performed before final closure of the diversion tunnels. Grouting of the transverse contraction joints 1-2, 2-3, 23-24, 24-25 will not be accomplished under this contract.

The contraction joints and the peripheries of the diversion tunnel plugs and backfill concrete shall be grouted in the sequence provided in Paragraph 52. The grouting systems for the tunnel plug periphery grouting shall be embedded in the lining of the diversion tunnels, and the grouting systems for the backfill concrete, including concrete placed in the excavation for drilling perimeter grout holes, shall be embedded in the backfill concrete with grout and vent outlets placed in holes drilled into the rock or concrete lining, all as shown on the drawings.

All grout for pressure grouting contraction joints shall consist of neat cement mixed with water. Cool water shall be used in the grout mixture to prevent quick setting of the grout, and water having temperatures above 70° F shall not be used. The cement to be used for pressure grouting shall be furnished by the contractor in accordance with Paragraph 95. All grout shall be mixed and pumped in accordance with the applicable provisions of Paragraph 77. The program of grouting, the time when each lift of a contraction joint shall be grouted, the grout mixture, the pressure applied,

and all other details of the grouting operations shall be in accordance with these specifications and as directed by the contracting officer.

The grouting of the contraction joints shall be done singly or in groups, as directed, and in separate successive lifts beginning at the foundation and finishing at the top of the dam. The grout feeder pipe shall extend close to the supply pipe for each lift of joint being grouted and shall have a connection with each supply pipe regulated by a valve. When more than one joint is being grouted at the same time, the grout shall be applied in rotation by batches or in such quantities as necessary to fill each joint at approximately the same rate and to complete the filling of all joint lifts at the same time. The grouting of each joint lift shall be completed before the grout takes its set in the grouting system but shall not be grouted so rapidly that the grout will not settle in the joint and in no case shall the time consumed in filling any lift of a joint be less than 2 hours.

The contractor shall provide all necessary facilities such as catwalks, ladders, and platforms to enable the engineers and inspectors to observe the grouting operations at each joint, and for quick and convenient passage from joint to joint as required. The contractor shall supply all labor, tools, and material required to assist in setting any dial gages or other devices used to indicate opening or closing of the joints during the grouting operation. The contractor shall provide a telephone communication and signal system for use during the washing, testing, and grouting operations. Before any lift of a joint is grouted, it shall be washed thoroughly with air and water under pressure and shall be allowed to remain filled with water for a period of 24 hours. Immediately prior to being grouted, the water shall be drained from the joint lifts to be grouted.

During the grouting operations, 2 or more joints, as determined by the contracting officer, of ungrouted joint lifts at the same level, shall be

filled with water to the level of the top of the lift being grouted. As the grouting of the lift of the joint nears completion, the grouting lift of the joint immediately above the lift being grouted shall be filled with water. Valves shall be used to control the flow of water into and from each joint. All accessible leaks discovered prior to grouting and all leaks occurring during the grouting operations shall be calked or otherwise stopped. Immediately after a grouting operation is completed, the water shall be drained from the joints in the lift above but shall not be drained from the adjacent ungrouted joint lifts at the same level until 6 hours after completion of the grouting operation. Joints, pipes, or formed drains into which grout has leaked shall be thoroughly washed out by alternately filling them with water and draining them until all grout has been removed, and all headers and outlets for each joint, pipe, or drain shall be tested and shall be clean before the joint, pipe, or drain shall be considered to be thoroughly washed out.

The grout shall be pumped into the supply header of the piping system for the lift. During the grouting of each lift of the joint the outlet ends of the vent pipes at the top of the lift shall have riser pipes about 5 feet in height and valves near the tops of the risers. The valves shall be left open until the lift is filled and only grout of proper consistency for retention in the joints remains in the risers, whereupon the valves shall be closed and the required pressure applied. The water and thin grout shall be bled from the top of the joint lifts and pressure shall be applied as many times as is determined by the contracting officer to be necessary to force all excess water from the grout. After the system ceases to take an appreciable amount of grout, the required final or residual pressure shall be maintained on the grout in the joint lift until the grout has taken its initial set. The simultaneous application of grout at 2 or more points in any one system shall be made if determined necessary from results of tests or previous groutings. After the cooling systems

have served their purpose, the pipes of the cooling systems embedded in the concrete of the dam, in concrete in diversion tunnel plugs and in backfill concrete in diversion tunnels shall be filled completely with grout. Immediately before the grouting is commenced, the water in the embedded cooling coils shall be completely blown out with air. The grout shall be held in the cooling coils until it has taken its initial set by means of valves on each end of the coils. Cooling coils in blocks 1, 2, 3, 23, 24, and 25 shall not be filled with grout as provided above. In these blocks, the water in the embedded cooling coils shall be completely blown out with air and the surface connections shall be capped.

Measurement for payment for pressure grouting contraction [sic] joints and cooling systems will be made on the basis of the number of sacks of cement actually forced into the contraction joints in the dam or required to fill permanent pipes. In measuring grout for payment, the volume of one sack of cement will be considered as 94 pounds. Payment for pressure grouting contraction joints and cooling systems will be made at the unit price per sack bid therefor in the schedule, which unit price shall include the cost of all labor, materials, plant, facilities, and operations required for the grouting; except that payment for furnishing and handling special cement for grouting contraction joints will be made at the unit price per barrel bid therefor in the schedule, and payment for hooking onto each contraction joint grouting system will be made as provided in Paragraph 80. No payment will be made for grout or for cement used in grout rejected by the contracting officer on account of improper mixing, or for grout lost by leakage due to failure of the contractor to calk leaks when directed. All pressure grouting operations shall be performed in the presence of the contracting officer or his duly authorized representative.

